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RUTGERS COLLEGE

New Brunswick New Jersey

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1918

CLASS OF 1882 GATEWAY.

DEPARTMENTS OF ENGINEERING

The Scientific School of Rutgers College was in 1864 by act of the legislature of the State of New Jersey declared to be "the state college for the benefit of agriculture and the mechanic arts." Under the provisions of this act there has been a steady and consistent development of the scientific courses, and now the following seven technical courses are offered in the Scientific School:

In Agriculture.
In Biology.
In Ceramics.
In Chemistry.
In Civil Engineering.
In Electrical Engineering.
In Mechanical Engineering.

Each of these courses occupies four years and leads to the degree of Bachelor of Science, (B. Sc.)

The requirements for admission to all courses are practically identical with those of other institutions of high standing.

Engineering

1918

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Sixty free scholarships, exempting the holders from all fees, amounting approximately to $160.00 per annum, are available each year to students resident in the State of New Jersey. These scholarships are awarded on the results of competitive examinations held in each county court house in the state on the first Friday and Saturday in June each year.

Catalogues and Circulars of Information containing full detailed information concerning entrance requirements, scholarships, courses of study, and expenses will be sent on application to Mr. Luther H. Martin, Assistant Registrar, Rutgers College, New Brunswick, N. J.

It is the purpose of this pamphlet to give a brief description of the facilities for instruction and the courses in Civil Engineering, Electrical Engineering and Mechanical Engineering in Rutgers College.

The Engineering Departments are housed in the Engineering Building, a large three-story brick building of fire-proof construction erected in 1908, containing the class rooms, drawing rooms and laboratories of the Engineering Departments.

The work of the Freshman year, which is taken in common by all engineering students, includes the study of English, German, Algebra, Analytical Geometry, Chemistry and Mechanical Drawing. Beginning with the Sophomore year the work of the several engineering courses begins to diverge and it gradually becomes more and more technical in character as described under the several headings given below.

QUEEN'S BUILDING.

ENGINEERING BUILDING.

CIVIL ENGINEERING

Civil Engineering embraces, among other operations, surveying and mapping large and small areas, determining boundaries, featuring topography, and showing the configuration of the ground both on land and under water; the designing and construction of railroads, highways, bridges and other structures intended to carry constant and varying loads; testing materials of construction; determining the extent of drainage surfaces for impounding water and the building of dams and reservoirs to supply power and for municipal requirements; the development of processes for purifying water for domestic and factory uses and the disposal of sewage and other wastes of municipalities in a sanitary manner.

The purpose of this course is to give the student, by recitations and lectures, laboratory and field exercises, a knowledge of the fundamentals upon which the practice of civil engineering in its various branches depends, to fit him to enter upon the practice of his profession able to understand and solve in detail the problems that may arise, to know how and where to derive proper information, and to have an intelligent and comprehensive view of his own and related engineering operations.

The object of laboratory and field exercises is to fix in the mind of the student proper methods of operation and the practical use of apparatus through an application of principles taught, rather than to make him a proficient practitioner in the use of apparatus and instruments. It is not expected to turn out the finished engineer at the end of a four years' course of study, but it is the aim to give the graduate a notable start in the profession and make it possible for him to increase his efficiency with the years of practice that follow.

The first two years of the course are devoted largely to elementary technical and general subjects. The technical studies aim to give a substantial foundation for the purely technical subjects of the last two years which take the place of general subjects in an increasingly larger proportion.

A two weeks' summer course in general surveying follows upon the completion of the studies of the Sophomore year.

The studies pursued during the Junior year include the general subjects of History and pure Mathematics and the technical subjects of Graphical Statics, Applied Geology, Mechanics and Strength of Materials, Elements of Electrical Engineering, Masonry Construction, and Railway Engineering, followed by a two weeks' summer school course of field work in the last named subject. The reconnoissance, preliminary and final locations of a short line of railroad are made, plans, profiles and cross-sections drawn, grades established, and quantities computed. Laboratory and field work and visits to nearby engineering structures are carried on during term time.

The subjects pursued in the Senior year include Economics and Political Science; Plain and Reinforced Concrete Construction; analytic and graphic determination of Stresses in Roofs, Bridges, Arches, Dams, and other structures; Elements of Machinery; Practical Astronomy, Geodesy, and Precise Levelling; Sanitary Engineering; Highway Engineering; Hydraulic Engineering, and the Designing of engineering structures of various kinds. Laboratory and Field practice are conducted during the term time throughout the year, as well as the necessary designing and computing connected therewith.

A SENIOR DRAWING ROOM.

LABORATORY AND FIELD WORK.—The laboratory practice of the Junior and Senior years consists in making standard tests of cements, mortars, and concretes; making tensile, compressive and transverse tests of the strength of various materials of construction; in tests on water meters and pumps; in calibrating pressure gages; in determining the coefficients for standard orifices and weirs and the reaction of jets; and in making a hydrographic survey and using current meters and rod floats to measure the water discharge of a river. The proximity of the college to the Delaware and Raritan Canal and the Raritan River offers peculiar advantages for much of this work in hydraulic engineering.

PRACTICE IN SURVEYING.

The field work in geodetic surveying consists in using precise methods in measuring base lines, horizontal angles, and in levelling. The work in the drafting room consists in plotting surveys, drawing topographical and contour maps, solving graphical problems, and desiging engineering structures such as arches, bridges, dams, roofs, retaining walls, etc.

LABORATORY APPARATUS, INSTRUMENTS.—The department possesses a large collection of models for illustrating problems in descriptive geometry and showing details of construction in wood, iron, brick, and stone; models of railroad switches and frogs; instruments of precision for geodetic surveying and for various other purposes; several complete outfits of surveying instruments; plane tables, levels, and other apparatus for efficient field work. The Cement Laboratory is equipped with testing machines for determining the strength of briquets, and other accessories for testing cements and mortars. A special apparatus for testing the porosity of cements and mortars, designed by Mr. George M. Taylor, a graduate of the College, and presented by him, is a valuable addition to the equipment. The Hydraulic Laboratory is equipped with apparatus for determining the coefficients for standard orifices, weirs, and short tubes; and with water meters, pumps, valves and fittings.

A TEST IN THE HYDRAULIC LABORATORY.

ELECTRICAL ENGINEERING

Electrical Engineering is chiefly concerned with the design, construction and operation of electrical machinery and its applications in the transmission and distribution of electrical energy for power and lighting.

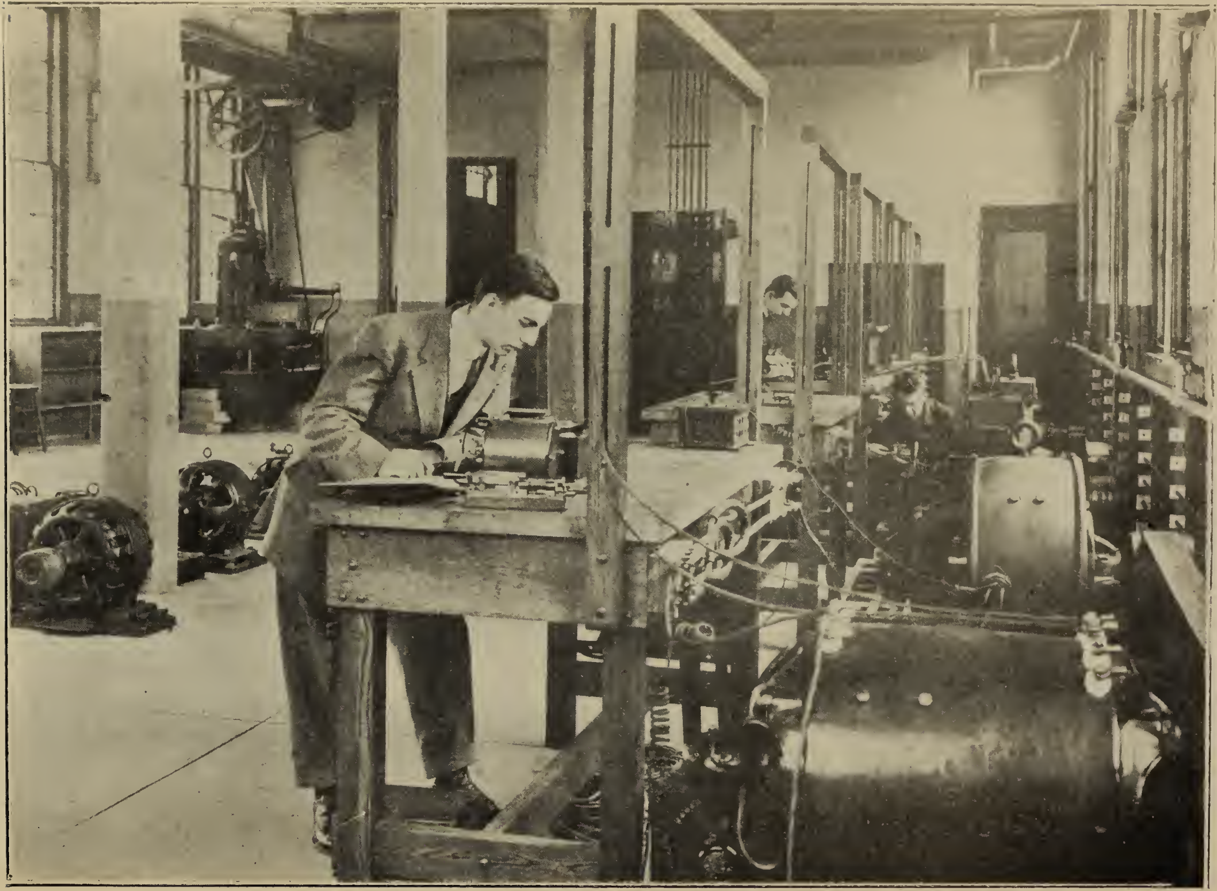
As subdivisions of this wide field we may mention the design, construction and operation of direct current generators and motors, alternators, transformers, synchronous and induction motors, rotary converters, and the various auxiliary apparatus associated with their use; the assembling of this apparatus in power houses and substations; the design and construction of transmission lines and the utilization of electrical energy for lighting and power distribution, including the application of electrical energy for the operation of railways.

The business side of the subject is especially important in the selling and purchasing of apparatus; in construction work, and in the operation of electric lighting and power plants.

The aim of this course is to give the student thorough instruction in the fundamental principles which underlie all branches of electrical engineering, to impart a broad knowledge of engineering facts and methods and to train him to think clearly and reason logically along engineering lines. While it must be understood that before a man can become an accomplished engineer he must supplement his technical training by a large practical experience and by contact with men and affairs, nevertheless this course will fit him to enter upon the profession of Electrical Engineering.

Experience has shown that in addition to technical training success in engineering depends very largely on one's ability to meet men of education and culture upon equal terms. To aid the student to meet this requirement and to broaden his outlook certain general or non-technical subjects are required of all engineering students throughout the four years of the course.

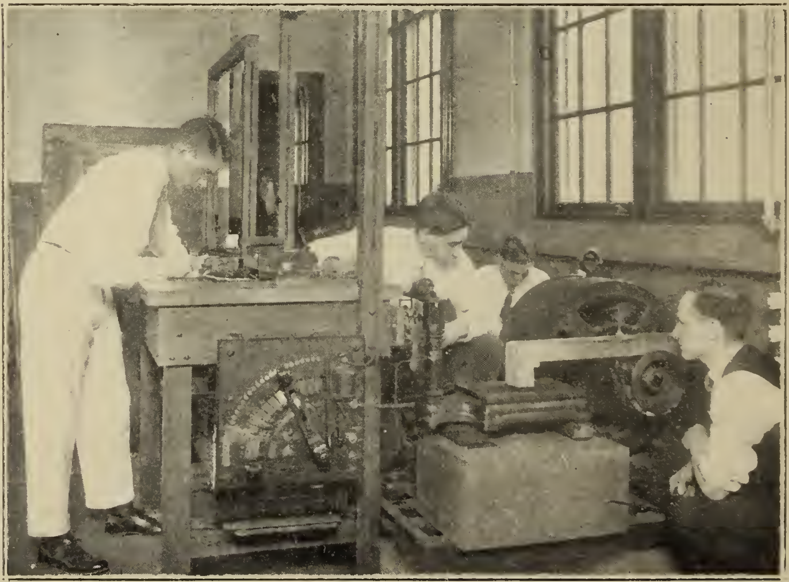
The work of the first two years is largely devoted to the study of English, French or German, Mathematics, Physics, Chemistry and Drafting, with some elementary technical subjects which serve as a foundation for the technical work of the Junior and Senior years. A knowledge of machine parts and their uses is imparted by lectures, recitations and shop-visits, and by the course in machine drawing of the Sophomore year.



DYNAMO LABORATORY.

Beginning with the Junior year the course becomes distinctly technical in character. Elements of Electrical Engineering given in the first term comprises the study of the construction, principles of operation and characteristics of direct current generators and motors, together with the elements of electric lighting and distribution. In the second term the study of Alternating Currents is begun, covering the elementary theory and principles of operation of alternating current generators, transformers, and induction motors. Both courses are accompanied by suitable laboratory work, in which the theory learned in the class-room is applied to the study of the apparatus itself. Practice is given in the solution of the problems involved in the distribution of electrical energy for light and power. A course in Steam Engineering is given by the Department of Mechanical Engineering.

The subjects pursued in the Senior year include Economics and Political Science; Advanced Alternating Currents, which comprises a thorough and somewhat detailed study of polyphase generators and transformers, synchronous motors, rotary converters. induction and other types of asynchronous motors; Electric Power Transmission, which includes the problems involved in the design, construction and



TESTING A DIRECT CURRENT MOTOR.

operation of high voltage transmission lines; and Electric Railways comprising the application of electric power for railway working and including a study of the construction, equipment and operation of electric railways. Many important problems in electrical engineering are worked out in detail to show the practical application of the theory and to train the student in engineering methods.

Those branches of Mechanical Engineering such as Applied Mechanics, Strength of Materials, Thermodynamics, and Steam Engineering, which experience has shown to be of especial value to an electrical engineer are given by the Department of Mechanical Engineering.

LABORATORY WORK.—The theoretical work in the class-room is paralleled by very extended courses in the laboratories which begin with the work in Chemistry and Physics and extend through all of the scientific branches studied. The work in the Electrical Testing Laboratories, the Dynamo Laboratory, and the Mechanical Laboratory is planned with the purpose of familiarizing the student with the various types of apparatus and machinery in commercial use, and at the same time of developing in him habits of accurate observation and of directing his attention to the importance of economy of time and precision of results to be expected in testing all types of electrical machinery and apparatus. In addition to the work during the college year there is a two weeks' summer course at the end of the Junior year in the Dynamo and Steam Engineering Laboratories.

LABORATORY FACILITIES.—The Electrical Testing Laboratories are provided with Wheatstone bridges; testing sets of various types; standards of resistance, capacity, inductance, and electromotive-force; potentiometers and their accessories for the measurement of resistance, capacity, inductance, etc., and for calibrating ammeters, voltmeters, wattmeters and other types of commercial instruments.

The Laboratory of Dynamo-Electric Machinery is equipped with a full line of direct and alternating current machinery which is always available for experimental purposes. Direct current is supplied from our own direct-connected generator driven by an Ames engine from a 135 H. P. Babcock & Wilcox boiler operated normally at 150 lbs. pressure. Alternating current is also available from the mains of the Public Service Corporation. The equipment includes Westinghouse, Crocker-Wheeler, and General Electric direct current motors, Crocker-Wheeler and Edison direct current generators, a double current generator, a Fort-Wayne rotary converter, a General Electric revolving field polyphase alternator which will furnish single-phase, two-phase, three-phase, quarter-phase or six-phase current as required, induction motors and transformers of various types and capacities, including a 24.5 K. W. 2200 volt constant current arc lighting transformer, a 7.5 K. W. potential regulator, a 5 K. W. reactance coil, and a large assortment of current transformers and commercial measuring instruments.

Inspection Trips.—At intervals during the college year students in Electrical Engineering are expected to visit manufactories and power plants under the guidance of the Professor of Electrical Engineering. Visits are usually made to the power stations of the Public Service Corporation of New Jersey, at Metuchen and Newark, the New York Edison Co., the Brooklyn Rapid Transit Co., the Interborough Railway Co., and the New York, New Haven and Hartford Railroad.

The works of the Crocker-Wheeler Co. at Ampere, N. J., and of the General Electric Co. at Schenectady, are usually visited each year.

TESTING A STEEL BAR.

MECHANICAL ENGINEERING

Mechanical Engineering is concerned with the design, construction and operation of machinery, as applied in the generation of power, in all kinds of manufacturing processes, and in transportation and allied lines of service. As sections of the wide field covered by this statement may be mentioned the designing and building of machines, the assembling and maintaining of them in plants and factories, the direction and organization of production, and business engineering: the commercial side is especially prominent in the selling and purchasing departments of large concerns and in contracting engineering.

The function of the college course is to train, instruct and equip recruits for the profession—trained to think clearly, instructed in underlying scientific principles, equipped with a good knowledge of engineering fact and method. To the general scientific training in mathematics, chemistry and physics the technical studies add a fuller and more detailed development of the scientific foundation of the particular branch of engineering, with especial emphasis upon mechanics and thermodynamics. In the way of technical knowledge only a beginning can be made, by learning the more important facts of engineering practice: the engineer must make continuous progress in the acquirement of the great body of systematized experience and evolved method which constitutes engineering.

During the first two years of the course, the general studies largely predominate, those in the line of mathematics and natural science necessarily preceding the more advanced engineering subjects. The technical work of these years is of an elementary and preparatory nature. The last two years, and especially the fourth, are largely devoted to engineering studies.

Work in the drafting room runs through the whole course. First comes mechanical drawing and projection, followed by machine drawing; these give training in the use of hand and instrument, in the representation of form, and in the technique of the engineering office. Then follow elementary kinematics, or the analysis of simple motions, and graphic statics, or the determining of forces in machines and structures. In the last year, much time is given to machine design and to advanced kinematics and dynamics.

Mechanical Technology or engineering practice is taught by lectures, recitations and shop-visits. As a distinct subject this runs through the Sophomore year and a two-weeks' summer course at the end of that year; incidentally it forms a part of nearly every one of the technical

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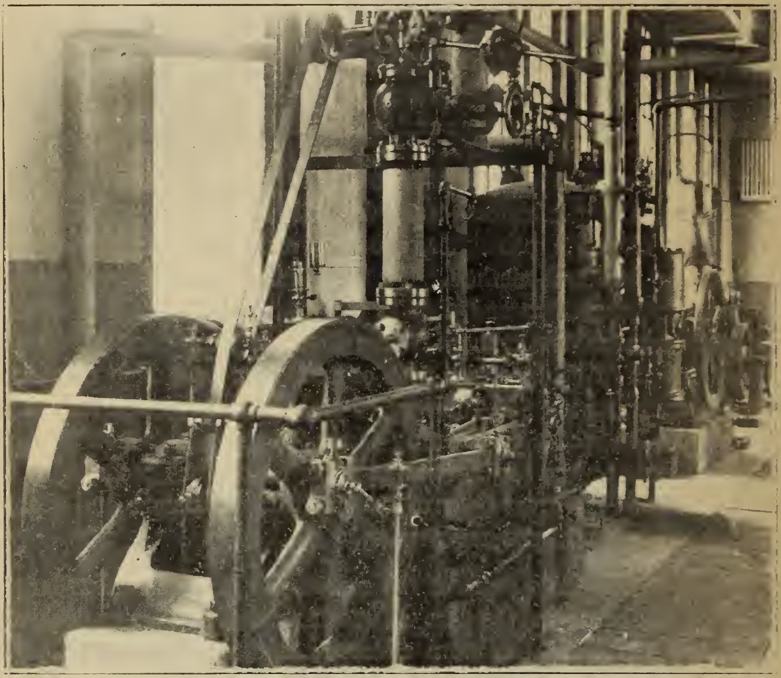
subjects taught. With it is closely allied a short course in shop work, covering simple processes in the forge shop and machine shop; but for knowledge of machine construction much dependence is placed upon visits of inspection to working shops. Students are urged to secure shop experience during the summer vacations.



VIEW IN MECHANICAL ENGINEERING LABORATORY.

The subject of general Mechanics is taught to all engineering students by the Department of Mathematics. A large part of the graphical work already outlined lies in the field of Mechanics of Machinery; each drawing course is accompanied by its text, and in a separate textbook course many of the important problems in the theory of machines are worked out, for the sake of specific result and of training in general methods.

In the Mechanics and Strength of Materials and in Machine Design, the properties of engineering materials and the principles of their behavior in machines and structures are studied and applied. The work in design begins with the proportioning of single parts, and goes forward to the original design of simple machines to meet specified conditions.